

Explanation of BCM formulas and cells

LOOP MODULE - INPUT TAB:

Column	Label	Formula
A	Company	Input - copied from output of data module
	Rural Low =	MOUNTAIN BELL - UT
	Rural High =	MOUNTAIN BELL - UT
	Urban Low =	MOUNTAIN BELL - UT
	Urban High =	MOUNTAIN BELL - UT

**

Column	Label	Formula
B	Clli	Input - copied from output of data module
	Rural Low =	MNPLUTMA
	Rural High =	MNPLUTMA
	Urban Low =	OGDNUTNO
	Urban High =	OGDNUTNO

**

Column	Label	Formula
C	Block Grp #	Input - copied from output of data module
	Rural Low =	490399721005
	Rural High =	490399721006
	Urban Low =	490572102021
	Urban High =	490572102023

**

Column	Label	Formula
D	Quadrant	Input - copied from output of data module
	Rural Low =	1
	Rural High =	4
	Urban Low =	1
	Urban High =	1

**

Column	Label	Formula
E	B	Input - copied from output of data module
	Rural Low =	1,477
	Rural High =	34,379
	Urban Low =	2,659
	Urban High =	12,513

**

Column	Label	Formula
F	A Fdr Portion	Input - copied from output of data module
	Rural Low =	0
	Rural High =	0
	Urban Low =	0
	Urban High =	0

**

Column	Label	Formula
G	Distr Distnc	Input - copied from output of data module
	Rural Low =	2,990
	Rural High =	36,438
	Urban Low =	2,505
	Urban High =	10,349

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Column	Label	Formula
H	Total HH	Input - copied from output of data module
	Rural Low =	338
	Rural High =	311
	Urban Low =	305
	Urban High =	45

**

Column	Label	Formula
I	Density in HH/Sq Mi	Input - copied from output of data module
	Rural Low =	589.32
	Rural High =	3.67
	Urban Low =	769.67
	Urban High =	6.59

**

Column	Label	Formula
J	Dist Ca Multplr	Input - copied from output of data module
	Rural Low =	0.279
	Rural High =	0.369
	Urban Low =	0.2905
	Urban High =	0.388

**

Column	Label	Formula
K	Fdr Ca Multplr	Input - copied from output of data module
	Rural Low =	0.279
	Rural High =	0.426
	Urban Low =	0.256
	Urban High =	0.4165

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Column	Label	Formula
L	Fiber Multplr	Input - copied from output of data module
	Rural Low =	1.404
	Rural High =	2.03
	Urban Low =	1.276
	Urban High =	3.4375

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Column	Label	Formula
M	B Sgmt Dist	=IF(AND(B2=B1,D2=D1),E2-E1,E2)
	Rural Low =	1476.795696

(If is false)

Column	Label	Formula
M	B Sgmt Dist	=IF(AND(B5=B4,D5=D4),E5-E4,E4)
	Rural High =	34379.11822

(If is false)

Column	Label	Formula
M	B Sgmt Dist	=IF(AND(B6=B5,D6=D5),E6-E5,E6)
	Urban Low =	2658.635473

(If is false)

Column	Label	Formula
M	B Sgmt Dist	=IF(AND(B10=B9,D10=D9),E10-E9,E10)
	Urban High =	2878.189122

(If is true)

Formula Description:

If the CLLI code and the quadrant are the same for the current CBG and the one next closer to the office, subtract the prior blocks total "B" feeder distance from the current total "B" distance to determine the length of the current "B" segment, otherwise show the total "B" for this CBG (it must be the first segment in the quadrant).

**

Column	Label	Formula
N		=+COUNTA(A2:A94)

Description:

Counts the number of entries in column A. It is a carryover from a prior version and not used in the model.

Input Tables and values directly entered in the sheet labeled Inputs:

Table:

4200	=Maximum Copper Feeder Cable Size
3600	=Maximum Copper Distribution Cable Size
144	=Maximum Fiber Cable Size

Description:

This area has inputs to recognize the maximum size of cable that will be employed in building the network. It comes from engineering data.

**

Table:

Fill Factors for Electronics	
0.8	AFC
0.8	SLC

Description:

These are the engineering maximum fill factors percentages used to engineer the electronic equipment.

**

Table:

Cable Fill factors		
	Feeder	Distribution
0	0.65	0.25
5	0.75	0.35
200	0.8	0.45
650	0.8	0.55
850	0.8	0.65
2550	0.8	0.75

Description:

This table provides the inputs by density zone for engineering fill factor percentages for both feeder and distribution cable. It represents the percentage of working pairs in the cable which when reached causes a new cable to be engineered and placed. The capacity above the fill percentage is the only facility available for maintenance replacement of faulty pairs and for growth.

**

Table:

Fiber Feeder UG/Aerial Mix Table		
Density	UG%	Aerial %
0-5	60	=100-R30
5-200	65	=100-R31
200-650	70	=100-R32
650-850	80	=100-R33
850-2550	90	=100-R34
>2550	100	=100-R35

Table:

Copper Feeder UG/Aerial Mix Table		
Density	UG%	Aerial %
0-5	60	=100-R40
5-200	65	=100-R41
200-650	70	=100-R42
650-850	80	=100-R43
850-2550	90	=100-R44
>2550	100	=100-R45

Table:

Distribution UG/Aerial Mix Table		
Density	UG%	Aerial %
0-5	90	=100-R50
5-200	80	=100-R51
200-650	70	=100-R52
650-850	65	=100-R53
850-2550	60	=100-R54
>2550	50	=100-R55

Description:

These three tables of inputs designate the percentages for each density group's split of cable placement between below ground and above ground facilities. Separate tables are provided for fiber feeder, copper feeder, and distribution. The % below ground is entered and the aerial reciprocal is then calculated. It is an estimate of the average national engineering data.

**

Table:

SLC Cost per Access Line
500

AFC Cost per Access Line
550

Description:

These cells are the non-discounted or small purchase volume average prices per line including engineering and installation. They are derived from manufacturer pricing and engineering cost data.

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Table:

Fiber Cable Discount %
(Enter whole % in space below)
20

Copper Cable Discount %
(Enter whole % in space below)
20

AFC Electronics Discount %
10

SLC electronics Discount %
20

Description:

These inputs are the average percent discounts applied to the purchase prices of the cable and electronics that are bought by the facility provider.

**

Table:

Fiber Cable Costs

Cable Size	Cost UG	Cost Aerial
144	5.56	5.24
96	3.8	3.53
72	2.84	2.65
60	2.41	2.23
48	1.98	1.84

36	1.6	1.46
24	1.18	1.05
18	0.98	0.85
12	0.79	0.66

Table:

Copper Feeder Costs

Cable Size	Cost UG	Cost Aerial
4200	25.7	25.4
3600	22.2	21.9
3000	18.8	18.5
2400	14.3	14.1
1800	12.44	12.24
1200	10.68	10
900	7.82	7.51
600	7.13	7.05
400	4.56	4.62
200	2.36	2.33
100	1.262	1.266

Table:

Copper Distribution Costs

Cable Size	Cost UG	Cost Aerial
3600	22.2	21.9
3000	18.8	18.5
2400	14.3	14.1
1800	12.44	12.235
1200	10.68	9.99569
900	7.82	7.5122
600	7.1326	7.0505
400	4.564	4.61668
200	2.363	2.334
100	1.262	1.266
50	0.675	0.572

Description:

These tables include the non-discounted or low volume prices for aerial and below ground fiber and copper cables. They are an average of supplier prices.

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LOOP MODULE - MAIN LOGIC TAB:

All cells in the logic area are the same within a column. Each row represents a CBG. All rows have the same logic e.g. cells A1 through A5300 are exactly the same. The same is true for all columns A through AG.

Cell:

Column	Label	Formula
A	Office	=Input!B2
	Rural Low =	MNPLUTMA
	Office	=Input!B5
	Rural High =	MNPLUTMA
	Office	=Input!B6
	Urban Low =	OGDNUTNO
	Office	=Input!B10
	Urban High =	OGDNUTNO

Description:

A carry forward of the CLLI code from the input sheet.

**

Cell:

Column	Label	Formula
B	Quadrant	=Input!D2
	Rural Low =	1
	Quadrant	=Input!D5
	Rural High =	4
	Quadrant	=Input!D6
	Urban Low =	1
	Quadrant	=Input!D10
	Urban High =	1

Description:

A carry forward of the quadrant from the input sheet

**

Cell:

Column	Label	Formula
C	BG sqnc #	=IF(OR(NOT(B2=B1),NOT(A2=A1)),1,C1+1)
	Rural Low =	1

(If is true)

Column	Label	Formula
C	BG sqnc #	=IF(OR(NOT(B5=B4),NOT(A5=A4)),1,C4+1)
	Rural High =	1

(If is true)

Column	Label	Formula
C	BG sqnc #	=IF(OR(NOT(B6=B5),NOT(A6=A5)),1,C5+1)
	Urban Low =	1

(If is true)

Column	Label	Formula
C	BG sqnc #	=IF(OR(NOT(B10=B9),NOT(A10=A9)),1,C9+1)
	Urban High =	5

(If is false)

Description:

This formula provides a sequence number for each of the CBGs in a quadrant. If the CLLI code or the quadrant are not the same as the prior CBG, the result is a 1. If they are the same, it adds 1 to the sequence number of the prior CBG.

**

Cell:

Column	Label	Formula
D	B	=Input!E2
	Rural Low =	1,477
	B	=Input!E5
	Rural High =	34,379
	B	=Input!E6
	Urban Low =	2,659
	B	=Input!E10
	Urban High =	12,513

Description:

A carry forward of the B feeder distance from the input sheet inputs.

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Cell:

Column	Label	Formula
E	Sgmt Dist	=Input!M2
	Rural Low =	1476.795696
	Sgmt Dist	=Input!M5
	Rural High =	34379.11822
	Sgmt Dist	=Input!M6
	Urban Low =	2658.635473
	Sgmt Dist	=Input!M10
	Urban High =	2878.189122

Description:

A carry forward of the feeder segment distance calculated in the input sheet.

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Cell:

Column	Label	Formula
F	Sgmt Type 1	=IF(B2=0,"",IF((D2+Input!F2+Input!G2)<12000,"Cable",IF(AND((D2+Input!F2+Input!G2)>=12000,Input!I2<=5),"AFC","SLC")))
	Rural Low =	Cable

(First if is false - second is true)

Column	Label	Formula
F	Sgmt Type 1	=IF(B5=0,"",IF((D5+Input!F5+Input!G5)<12000,"Cable",IF(AND((D5+Input!F5+Input!G5)>=12000,Input!I5<=5),"AFC","SLC")))
	Rural High =	AFC

(First 2 ifs are false - third is true)

Column	Label	Formula
F	Sgmt Type 1	=IF(B6=0,"",IF((D6+Input!F6+Input!G6)<12000,"Cable",IF(AND((D6+Input!F6+Input!G6)>=12000,Input!I6<=5),"AFC","SLC")))

Urban Low = Cable

(First if is false - second is true)

Column	Label	Formula
F	Sgmt Type 1	=IF(B10=0,"",IF((D10+Input!F10+Input!G10)<12000,"Cable",IF(AND((D10+Input!F10+Input!G10)>=12000,Input!I10<=5),"AFC","SLC")))

Urban High = SLC

(All ifs are false)

Description:

If there is nothing in the quadrant column, leave the cell blank, otherwise determine the total loop length by summing the B Feeder distance, the A Feeder distance, and the distribution distance. If it is less than 12000 feet put "Cable" in the cell. If it is more than 12000 feet and the density input for the CBG is less than or equal to 5, put "AFC" in the cell. If neither of these conditions are met, put "SLC" in the cell. This formula determines the type of facility technology needed for the CBG.

**

Cell:

Column	Label	Formula
G	Type 1 HH	=Input!H2
	Rural Low =	338
	Type 1 HH	=Input!H5
	Rural High =	311
	Type 1 HH	=Input!H6
	Urban Low =	305
	Type 1 HH	=Input!H10
	Urban High =	45

Description:

This is a carry forward of the number of households in the CBG.

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Cell:

Column	Label	Formula
H	Sgmt Type 2	=IF(B2=0,"",IF(OR(C3=1,AND(A2=A3,B2=B3,F2=F3,ISBLANK(H3))),"",IF(NOT(F2=F3),F3,H3)))
	Rural Low =	AFC

(Values of if are false)

Column	Label	Formula
H	Sgmt Type 2	=IF(B5=0,"",IF(OR(C6=1,AND(A5=A6,B5=B6,F5=F6,ISBLANK(H6))),"",IF(NOT(F5=F6),F6,H6)))

Rural High =

(First if is false - second is true)

Column	Label	Formula
H	Sgmt Type 2	=IF(B6=0,"",IF(OR(C7=1,AND(A6=A7,B6=B7,F6=F7,ISBLANK(H7))),"",IF(NOT(F6=F7),F7,H7)))
	Urban Low =	SLC

(Both ifs are false)

Column	Label	Formula
H	Sgmt Type 2	=IF(B10=0,"",IF(OR(C11=1,AND(A10=A11,B10=B11,F10=F11,ISBLANK(H11))),"",IF(NOT(F10=F11),F11,H11)))
	Urban High =	
	(First if is false - second is true)	

Description:

This formula determines if a second facility type must be provided in the feeder segment. If any block group further from the wire center requires different facilities than the current block group, it shows the second facility type required.

**

Cell:

Column	Label	Formula
I	Sgmt Type 3	=IF(B2=0,"",IF(OR(C3=1,AND(A2=A3,B2=B3,H2=H3,ISBLANK(I3))),"",IF(NOT(H2=H3),H3,I3)))
	Rural Low =	
	(Both ifs are false)	

Column	Label	Formula
I	Sgmt Type 3	=IF(B5=0,"",IF(OR(C6=1,AND(A5=A6,B5=B6,H5=H6,ISBLANK(I6))),"",IF(NOT(H5=H6),H6,I6)))
	Rural High =	
	(First if is false - second is true)	

Column	Label	Formula
I	Sgmt Type 3	=IF(B6=0,"",IF(OR(C7=1,AND(A6=A7,B6=B7,H6=H7,ISBLANK(I7))),"",IF(NOT(H6=H7),H7,I7)))
	Urban Low =	
	(First if is false - second is true)	

Column	Label	Formula
I	Sgmt Type 3	=IF(B10=0,"",IF(OR(C11=1,AND(A10=A11,B10=B11,H10=H11,ISBLANK(I11))),"",IF(NOT(H10=H11),H11,I11)))
	Urban High =	
	(First if is false - second is true)	

Description:

This formula determines if a third facility type must be provided in the feeder segment. If any block group further from the wire center requires two facility types different than the current block group, it shows the third facility type required.

**

Cell:

Column	Label	Formula
J	HH on Cpr	=IF(F2="Cable",IF(OR(C3=1,AND(NOT(C3=1),NOT(F2=F3),NOT(H2="Cable"),NOT(I2="Cable")),ISBLANK(J3)),G2,G2+J3),IF(OR(H2="Cable",I2="Cable"),J3,0))
	Rural Low =	338
	(Values are true)	

Column	Label	Formula
J	HH on Cpr	=IF(F5="Cable",IF(OR(C6=1,AND(NOT(C6=1),NOT(F5=F6),NOT(H5="Cable")),NOT(I5="Cable")),ISBLANK(J6)),G5,G5+J6),IF(OR(H5="Cable",I5="Cable"),J6,0))
	Rural High =	0
	(Values are false)	

Column	Label	Formula
J	HH on Cpr	=IF(F6="Cable",IF(OR(C7=1,AND(NOT(C7=1),NOT(F6=F7),NOT(H6="Cable")),NOT(I6="Cable")),ISBLANK(J7)),G6,G6+J7),IF(OR(H6="Cable",I6="Cable"),J7,0))
	Urban Low =	852
	(Values are false)	

Column	Label	Formula
J	HH on Cpr	=IF(F10="Cable",IF(OR(C11=1,AND(NOT(C11=1),NOT(F10=F11),NOT(H10="Cable")),NOT(I10="Cable")),ISBLANK(J11)),G10,G10+J11),IF(OR(H10="Cable",I10="Cable"),J11,0))
	Urban High =	0
	(Values are false)	

Description:

The model accumulates the households by facility type from the farthest CBG back along the feeder quadrant. This formula calculates the cumulative households that are riding any copper facilities required in this feeder segment.

**

Cell:

Column	Label	Formula
K	HH on SLC	=IF(\$F2="SLC",IF(OR(\$C3=1,AND(NOT(\$C3=1),NOT(\$F2=\$F3),NOT(H2="SLC")),NOT(I2="SLC")),ISBLANK(K3)),G2,G2+K3),IF(OR(\$H2="SLC",I2="SLC"),K3,0))
	Rural Low =	0
	(Values are false)	

Column	Label	Formula
K	HH on SLC	=IF(\$F5="SLC",IF(OR(\$C6=1,AND(NOT(\$C6=1),NOT(\$F5=\$F6),NOT(H5="SLC")),NOT(I5="SLC")),ISBLANK(K6)),G5,G5+K6),IF(OR(\$H5="SLC",I5="SLC"),K6,0))
	Rural High =	0
	(Values are false)	

Column	Label	Formula
K	HH on SLC	=IF(\$F6="SLC",IF(OR(\$C7=1,AND(NOT(\$C7=1),NOT(\$F6=\$F7),NOT(H6="SLC")),NOT(I6="SLC")),ISBLANK(K7)),G6,G6+K7),IF(OR(\$H6="SLC",I6="SLC"),K7,0))
	Urban Low =	401
	(First if value is false - second is true)	

Column	Label	Formula
K	HH on SLC	=IF(\$F10="SLC",IF(OR(\$C11=1,AND(NOT(\$C11=1),NOT(\$F10=\$F11),NOT(H10="SLC")),NOT(I10="SLC")),ISBLANK(K11)),G10,G10+K11),IF(OR(\$H10="SLC",I10="SLC"),K11,0))
	Urban High =	45
	(Values are true)	

Description:

This formula calculates the cumulative households that are riding any SLC 2000 facilities required in this feeder segment.

**

Cell:

Column	Label	Formula
L	# fibers for SLC Rural Low =	=IF(K2=0,0,IF(C3=1,4,IF(K2=K3,L3.L3+4)))
	Rural Low =	0

(Values are true)

Column	Label	Formula
L	# fibers for SLC Rural High =	=IF(K5=0,0,IF(C6=1,4,IF(K5=K6,L6.L6+4)))
	Rural High =	0

(Values are true)

Column	Label	Formula
L	# fibers for SLC Urban Low =	=IF(K6=0,0,IF(C7=1,4,IF(K6=K7,L7.L7+4)))
	Urban Low =	8

(Values of if are false, false, and true)

Column	Label	Formula
L	# fibers for SLC Urban High=	=IF(K10=0,0,IF(C11=1,4,IF(K10=K11,L11.L11+4)))
	Urban High=	4

(First value is false - second is true)

Description:

This formula calculates the cumulative number of fibers required for SLC 200 in this feeder segment. It adds 4 fibers to the number required by the next block group that is further out if this CBG is served by SLC. Otherwise, it just carries forward the next block groups number of SLC fibers.

**

Cell:

Column	Label	Formula
M	HH on AFC Rural Low =	=IF(\$F2="AFC",IF(OR(\$C3=1,AND(NOT(\$C3=1),NOT(\$F2=\$F3),NOT(H2="AFC"),NOT(I2="AFC")),ISBLANK(M3)),\$G2,\$G2+M3),IF(OR(\$H2="AFC",I2="AFC"),M3,0))
	Rural Low =	198

(First value is false - second is true)

Column	Label	Formula
M	HH on AFC Rural High =	=IF(\$F5="AFC",IF(OR(\$C6=1,AND(NOT(\$C6=1),NOT(\$F5=\$F6),NOT(H5="AFC"),NOT(I5="AFC")),ISBLANK(M6)),\$G5,\$G5+M6),IF(OR(\$H5="AFC",I5="AFC"),M6,0))
	Rural High =	311

(Both values are true)

Column	Label	Formula
M	HH on AFC Urban Low =	=IF(\$F6="AFC",IF(OR(\$C7=1,AND(NOT(\$C7=1),NOT(\$F6=\$F7),NOT(H6="AFC"),NOT(I6="AFC")),ISBLANK(M7)),\$G6,\$G6+M7),IF(OR(\$H6="AFC",I6="AFC"),M7,0))
	Urban Low =	0

(All values are false)

Column	Label	Formula
M	HH on AFC	=IF(\$F10="AFC",IF(OR(\$C11=1,AND(NOT(\$C11=1),NOT(\$F10=\$F11),NOT(H10="AFC")),NOT(I10="AFC")),ISBLANK(M11)),\$G10.\$G10+M11),IF(OR(\$H10="AFC",\$I10="AFC"),M11,0))
	Urban High=	0

(All values are false)

Description:

This formula calculates the cumulative households that are riding any AFC type facilities required in this feeder segment.

**

Cell:

Column	Label	Formula
N	# AFC fbrs this BG	=IF(OR(M2=0,NOT(F2="AFC")),0,(CEILING(G2/(672*\$AL\$2),1))*4)
	Rural Low =	0

(Value is true)

Column	Label	Formula
N	# AFC fbrs this BG	=IF(OR(M5=0,NOT(F5="AFC")),0,(CEILING(G5/(672*\$AL\$2),1))*4)
	Rural High =	4

(If is false)

Column	Label	Formula
N	# AFC fbrs this BG	=IF(OR(M6=0,NOT(F6="AFC")),0,(CEILING(G6/(672*\$AL\$2),1))*4)
	Urban Low =	0

(If is true)

Column	Label	Formula
N	# AFC fbrs this BG	=IF(OR(M10=0,NOT(F10="AFC")),0,(CEILING(G10/(672*\$AL\$2),1))*4)
	Urban High=	0

(If is true)

Description:

If AFC facilities are required for this CBG, the number of AFC fibers are calculated at 4 fibers for each 672 AFC households times the AFC fill factor or fraction thereof. The CEILING function rounds the fractional number that is the result of (block group households/(672 times fill factor)) to the next increment shown after the number to be rounded - in this case 1. So .7 rounds to 1 & 3.6 rounds to 4.

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Cell:

Column	Label	Formula
O	TTL # AFC fibers	=IF(M2=0,0,(CEILING(M2/(672*\$AL\$2),1))*4)
	Rural Low =	4

(If is false)

Column	Label	Formula
O	TTL # AFC fibers	=IF(M5=0,0,(CEILING(M5/(672*\$AL\$2),1))*4)
	Rural High =	4

(If is false)

Column	Label	Formula
O	TTL # AFC fibers	=IF(M6=0,0,(CEILING(M6/(672*\$AL\$2),1))*4)
	Urban Low =	0

(If is true)

Column	Label	Formula
O	TTL # AFC fibers	=IF(M10=0,0,(CEILING(M10/(672*\$AL\$2),1))*4)
	Urban High=	0

(If is true)

Description:

This formula is similar to the one above except calculates the cumulative number of AFC fibers required to be served in this feeder segment.

**

Cell:

Column	Label	Formula
P	BG% AFC Fbrs	=IF(O2=0,0,N2/O2)
	Rural Low =	0.00

(If is false)

Column	Label	Formula
P	BG% AFC Fbrs	=IF(O5=0,0,N5/O5)
	Rural High =	1.00

(If is false)

Column	Label	Formula
P	BG% AFC Fbrs	=IF(O6=0,0,N6/O6)
	Urban Low =	0.00

(If is true)

Column	Label	Formula
P	BG% AFC Fbrs	=IF(O10=0,0,N10/O10)
	Urban High=	0.00

(If is true)

Description

This formula calculates the fraction that the current block group AFC fibers is of the accumulative number.

**

Cell:

Column	Label	Formula
Q	CA strtr %	=IF(NOT(F2="Cable"),0,IF(H2="",1,IF(I2="",0.9,0.8)))
	Rural Low =	0.9

(Both ifs are false)

Column	Label	Formula
Q	CA strtr %	=IF(NOT(F5="Cable"),0,IF(H5="",1,IF(I5="",0.9,0.8)))
	Rural High =	0

(If is true)

Column	Label	Formula
Q	CA strtr %	=IF(NOT(F6="Cable"),0,IF(H6="",1,IF(I6="",0.9,0.8)))
	Urban Low =	0.9

(Both ifs are false)

Column	Label	Formula
Q	CA strtr %	=IF(NOT(F10="Cable"),0,IF(H10="",1,IF(I10="",0.9,0.8)))
	Urban High=	0

(If is true)

Cell:

Column	Label	Formula
R	SLC Strtr %	=IF(F2="SLC",IF(H2="",1,0.5),IF(OR(H2="SLC",I2="SLC"),0.1,0))
	Rural Low =	0

(Ifs are both false)

Column	Label	Formula
R	SLC Strtr %	=IF(F5="SLC",IF(H5="",1,0.5),IF(OR(H5="SLC",I5="SLC"),0.1,0))
	Rural High =	0

(Ifs are both false)

Column	Label	Formula
R	SLC Strtr %	=IF(F6="SLC",IF(H6="",1,0.5),IF(OR(H6="SLC",I6="SLC"),0.1,0))
	Urban Low =	0.1

(First if is false - second is true)

Column	Label	Formula
R	SLC Strtr %	=IF(F10="SLC",IF(H10="",1,0.5),IF(OR(H10="SLC",I10="SLC"),0.1,0))
	Urban High=	1

(Both ifs are true)

Cell:

Column	Label	Formula
S	AFS Strtr %	=1-R2-Q2
	Rural Low =	0.1

Column	Label	Formula
S	AFS Strtr %	=1-R5-Q5
	Rural High =	1

Column	Label	Formula
S	AFS Strtr %	=1-R6-Q6
	Urban Low =	0

Column	Label	Formula
S	AFS Strtr %	=1-R10-Q10
	Urban High=	0

Description

These three formulae calculate the percentages of the structure cost that are assigned to each facility type within the feeder segment. The allocation of structure cost can be shown in a table as follows:

	CABLE %	SLC%	AFC%
Copper only	100%		
SLC only		100%	
AFC only			100%
All 3 present	80%	10%	10%
Copper and SLC	90%	10%	
Copper and AFC	90%		10%
SLC and AFC		50%	50%

(These allocations will be modified in the next version of BCM to reflect SLC and AFC allocations based on # of fibers each uses. The fiber % when both fiber and copper are present will be an input.)

**

Cell:

Column	Label	Formula
T	Copper Multplr	=Input!K2*Q2
	Rural Low =	0.2511

Column	Label	Formula
T	Copper Multplr	=Input!K5*Q5
	Rural High =	0

Column	Label	Formula
T	Copper Multplr	=Input!K6*Q6
	Urban Low =	0.2304

Column	Label	Formula
T	Copper Multplr	=Input!K10*Q10
	Urban High=	0

Description

This cell adjusts the copper structure ratio when more than one facility type is present in the feeder segment. It applies the copper structure ratio from column Q above to the copper feeder structure multiplier input carried forward from the input sheet Column K and the data module.

**

Cell:

Column	Label	Formula
U	Fiber Multiplr	=Input!L2*(R2+S2)
	Rural Low =	0.1404

Column	Label	Formula
U	Fiber Multiplr	=Input!L5*(R5+S5)
	Rural High =	2.03

Column	Label	Formula
U	Fiber Multiplr	=Input!L6*(R6+S6)
	Urban Low =	0.1276

Column	Label	Formula
U	Fiber Multiplr	=Input!L10*(R10+S10)
	Urban High=	3.4375

Description

This cell adjusts the fiber structure ratio when both copper and fiber are present in the feeder segment. It applies the sum of the SLC and AFC structure %s from columns R & S above to the fiber feeder structure multiplier input carried forward from the input sheet Column L and the data module.

**

Cell:

Column	Label	Formula
V	Distr Multiplr	=Input!J2
	Rural Low =	0.279
	Distr Multiplr	=Input!J5
	Rural High =	0.369
	Distr Multiplr	=Input!J6
	Urban Low =	0.2905
	Distr Multiplr	=Input!J10
	Urban High=	0.388

Description

This cell carries forward, from the input sheet, the distribution structure multiplier calculated in the data module.

**

Cell:

Column	Label	Formula
W	Cpr Fdr Prs	=J2/VLOOKUP(Input!I2,\$AL\$71:\$AO\$76,2)
	Rural Low =	423

Column	Label	Formula
W	Cpr Fdr Prs	=J5/VLOOKUP(Input!I5,\$AL\$71:\$AO\$76,2)
	Rural High =	0

Column	Label	Formula
W	Cpr Fdr Prs	=J6/VLOOKUP(Input!I6,\$AL\$71:\$AO\$76,2)
	Urban Low =	1065

Column	Label	Formula
W	Cpr Fdr Prs	=J10/VLOOKUP(Input!I10,\$AL\$71:\$AO\$76,2)
	Urban High=	0

Description

This cell divides the number of households by the fill factor for the density group to calculate the correct number of pairs required to serve the cumulative households on copper in the feeder segment.

VLOOKUP uses the following format: VLOOKUP(value to search for, range to search, column in the range to search). VLOOKUP searches down the first column of the range and goes to the line just above where the value fits in the column if there is not an exact fit, then goes across to the designated column. If there is an exact fit to the value being searched for, the line where the exact value fit is used to search across to the answer column. The result reported is the value found in that answer cell. If the values in the first column from top to bottom were 30, 20, and 10 and VLOOKUP was searching for 16, it would go to the line with 20. If it were searching for 10, it would go to the line with 10.

In this case, VLOOKUP searches down the first column of the fill factor table for the density found for this CBG (from column I) and reports the fill factor found in the second column of the table.

**

Cell:

Column	Label	Formula
X	Cpr Fdr Size	<u>=IF(NOT(W2=0),INDEX(\$AL\$42:\$AL\$52,MATCH(W2-(\$AL\$36*Y2),\$AL\$42:\$AL\$52,-1),1),0)</u> Rural Low = 600

(If is true)

Column	Label	Formula
X	Cpr Fdr Size	<u>=IF(NOT(W5=0),INDEX(\$AL\$42:\$AL\$52,MATCH(W5-(\$AL\$36*Y5),\$AL\$42:\$AL\$52,-1),1),0)</u> Rural High = 0

(If is false)

Column	Label	Formula
X	Cpr Fdr Size	<u>=IF(NOT(W6=0),INDEX(\$AL\$42:\$AL\$52,MATCH(W6-(\$AL\$36*Y6),\$AL\$42:\$AL\$52,-1),1),0)</u> Urban Low = 1200

(If is true)

Column	Label	Formula
X	Cpr Fdr Size	<u>=IF(NOT(W10=0),INDEX(\$AL\$42:\$AL\$52,MATCH(W10-(\$AL\$36*Y10),\$AL\$42:\$AL\$52,-1),1),0)</u> Urban High= 0

(If is false)

Description:

Two new functions are used in this formula - INDEX and MATCH. The format for INDEX is: INDEX(the range to search, the row number to go to, & the column number to go to). MATCH format is MATCH(value to look up, range to look in, & -1 means use the smallest value greater than or equal to the lookup value). MATCH gives a cell address (the row number index needs). INDEX reports a value in the answer cell.

In this case, the number of pairs required for the “B” portion of the feeder cable is calculated less any pairs assigned to maximum size cables(See next formula). MATCH looks up this residual number of pairs in the copper feeder size table and finds the next largest size cable. It reports the row number in that table. INDEX looks in the same table at the row number set by INDEX and reports the value of the cable size. This combination of functions will accurately size the cable and prevent errors possible in a straight lookup.

**

Cell:

Column	Label	Formula
Y	+# Max Size Ca	=TRUNC(IF(W2>\$AL\$36,W2/\$AL\$36,0))
	Rural Low =	0

(If is false)

Column	Label	Formula
Y	+# Max Size Ca	=TRUNC(IF(W5>\$AL\$36,W5/\$AL\$36,0))
	Rural High =	0

(If is false)

Column	Label	Formula
Y	+# Max Size Ca	=TRUNC(IF(W6>\$AL\$36,W6/\$AL\$36,0))
	Urban Low =	0

(If is false)

Column	Label	Formula
Y	+# Max Size Ca	=TRUNC(IF(W10>\$AL\$36,W10/\$AL\$36,0))
	Urban High=	0

(If is false)

Description:

If the number of pairs required for the feeder segment is greater than the maximum cable size input, this formula divides the total pairs required by the maximum size and truncates any fraction from the answer. For example, if total divided by maximum size = 2.287, TRUNC will report 2. If pairs required are less than maximum, this formula reports 0.

**

Cell:

Column	Label	Formula
Z	"A" Fdr Prs	=IF(F2="Cable",G2/VLOOKUP(Input!I2,\$AL\$71:\$AO\$76,2),0)
	Rural Low =	423

(If is true)

Column	Label	Formula
Z	"A" Fdr Prs	=IF(F5="Cable",G5/VLOOKUP(Input!I5,\$AL\$71:\$AO\$76,2),0)
	Rural High =	0

(If is false)

Column	Label	Formula
Z	"A" Fdr Prs	=IF(F6="Cable",G6/VLOOKUP(Input!I6,\$AL\$71:\$AO\$76,2),0)
	Urban Low =	381

(If is true)

Column	Label	Formula
Z	"A" Fdr Prs Urban High=	=IF(F10="Cable",G10/VLOOKUP(Input!I10,\$AL\$71:\$AO\$76,2),0)
		0

(If is false)

Description:

If the current CBG is served by copper, this formula calculates the number of pairs required for the "A" portion of the feeder. (Households are divided by fill factor for the density group.) See VLOOKUP notes under column W formula.

**

Cell:

Column	Label	Formula
AA	"A" Fdr Size Rural Low =	=IF(NOT(Z2=0),INDEX(\$AL\$42:\$AL\$52,MATCH(Z2-(\$AL\$36*AB2),\$AL\$42:\$AL\$52,-1),1),0)
		600

(If is true)

Column	Label	Formula
AA	"A" Fdr Size Rural High =	=IF(NOT(Z5=0),INDEX(\$AL\$42:\$AL\$52,MATCH(Z5-(\$AL\$36*AB5),\$AL\$42:\$AL\$52,-1),1),0)
		0

(If is false)

Column	Label	Formula
AA	"A" Fdr Size Urban Low =	=IF(NOT(Z6=0),INDEX(\$AL\$42:\$AL\$52,MATCH(Z6-(\$AL\$36*AB6),\$AL\$42:\$AL\$52,-1),1),0)
		400

(If is true)

Column	Label	Formula
AA	"A" Fdr Size Urban High=	=IF(NOT(Z10=0),INDEX(\$AL\$42:\$AL\$52,MATCH(Z10-(\$AL\$36*AB10),\$AL\$42:\$AL\$52,-1),1),0)
		0

(If is false)

Description:

This formula uses the combined INDEX and MATCH functions to look up the appropriate "A" feeder cable size for the current CBG from the copper feeder size table in the same way as the "B" feeder sizing in column X. It is the residual size after any maximums are calculated.

**

Cell:

Column	Label	Formula
AB	+# Max Size "A" Ca Rural Low =	=TRUNC(IF(Z2>\$AL\$36,Z2/\$AL\$36,0))
		0

(If is false)

Column	Label	Formula
AB	+# Max Size "A" Ca Rural High =	=TRUNC(IF(Z5>\$AL\$36,Z5/\$AL\$36,0))
		0

(If is false)

Column	Label	Formula
AB	+# Max Size "A" Ca Urban Low =	<u>=TRUNC(IF(Z6>\$AL\$36,Z6/\$AL\$36,0))</u> 0

(If is false)

Column	Label	Formula
AB	+# Max Size "A" Ca Urban High=	<u>=TRUNC(IF(Z10>\$AL\$36,Z10/\$AL\$36,0))</u> 0

(If is false)

Description:

This formula calculates the number of maximum size "A" feeder cables required to serve the current CBG in the same manner as maximum "B" sizes were determined.

**

Cell:

Column	Label	Formula
AC	Distr Prs/4 Rural Low =	<u>=(G2/VLOOKUP(Input!I2,\$AL\$71:\$AO\$76.3))/4</u> 188

Column	Label	Formula
AC	Distr Prs/4 Rural High =	<u>=(G5/VLOOKUP(Input!I5,\$AL\$71:\$AO\$76.3))/4</u> 311

Column	Label	Formula
AC	Distr Prs/4 Urban Low =	<u>=(G6/VLOOKUP(Input!I6,\$AL\$71:\$AO\$76.3))/4</u> 139

Column	Label	Formula
AC	Distr Prs/4 Urban High=	<u>=(G10/VLOOKUP(Input!I10,\$AL\$71:\$AO\$76.3))/4</u> 32

Description:

This formula calculates the number of distribution pairs required in each of the 4 CBG distribution cables. It is households divided by the density group fill factor (look down the fill factor table for the density found in column I of this row and across to the value in column 3) and then further divided by 4.

**

Cell:

Column	Label	Formula
AD	Distr Size Rural Low =	<u>=INDEX(\$A\$57:\$AL\$67,MATCH(AC2-(\$AN\$36*AE2),\$AL\$57:\$AL\$67,-1),1)</u> 200

Column	Label	Formula
AD	Distr Size Rural High =	<u>=INDEX(\$A\$57:\$AL\$67,MATCH(AC5-(\$AN\$36*AE5),\$AL\$57:\$AL\$67,-1),1)</u> 400

Column	Label	Formula
AD	Distr Size	<u>=INDEX(\$A\$57:\$AL\$67,MATCH(AC6-(\$AN\$36*AE6),\$AL\$57:\$AL\$67,-1),1)</u>

Urban Low = 200

Column	Label	Formula
AD	Distr Size	<u>=INDEX(\$AL\$57:\$AL\$67,MATCH(AC10-(\$AN\$36*AE10),\$AL\$57:\$AL\$67,-1),1)</u>
	Urban High=	50

Description:

This formula finds the size for each of the four CBG distribution cables. It searches the distribution size table for the correct residual cable size required after any maximum cable pairs calculated below in AE are subtracted.

**

Cell:

Column	Label	Formula
AE	+# Max Size Ca	<u>=TRUNC(IF(AC2>\$AN\$36,AC2/\$AN\$36,0))</u>
	Rural Low =	0

(If is false)

Column	Label	Formula
AE	+# Max Size Ca	<u>=TRUNC(IF(AC5>\$AN\$36,AC5/\$AN\$36,0))</u>
	Rural High =	0

(If is false)

Column	Label	Formula
AE	+# Max Size Ca	<u>=TRUNC(IF(AC6>\$AN\$36,AC6/\$AN\$36,0))</u>
	Urban Low =	0

(If is false)

Column	Label	Formula
AE	+# Max Size Ca	<u>=TRUNC(IF(AC10>\$AN\$36,AC10/\$AN\$36,0))</u>
	Urban High=	0

(If is false)

Description:

This formula calculates the number of maximum size distribution cables required to serve the current CBG in the same manner as maximum feeder sizes were determined. It matches the distribution cable size required to the maximum size and, if the pairs required are greater, calculates how many maximum size cables are required.

**

Cell:

Column	Label	Formula
AF	# Fibers Rqr'd	<u>=L2+O2</u>
	Rural Low =	4

Column	Label	Formula
AF	# Fibers Rqr'd	<u>=L5+O5</u>
	Rural High =	4

Column	Label	Formula
AF	# Fibers Rqr'd Urban Low =	$\frac{L6+O6}{8}$

Column	Label	Formula
AF	# Fibers Rqr'd Urban High=	$\frac{L10+O10}{4}$

Description:

This formula sums the SLC and AFC number of fibers required in the feeder segment.

**

Cell:

Column	Label	Formula
AG	# Max Size Fiber Ca Rural Low =	$=\text{TRUNC}(\text{IF}(\text{AF2}>\$AN\$29,\text{AF2}/\$AN\$29,0))$

(If is false)

Column	Label	Formula
AG	# Max Size Fiber Ca Rural High =	$=\text{TRUNC}(\text{IF}(\text{AF5}>\$AN\$29,\text{AF5}/\$AN\$29,0))$

(If is false)

Column	Label	Formula
AG	# Max Size Fiber Ca Urban Low =	$=\text{TRUNC}(\text{IF}(\text{AF6}>\$AN\$29,\text{AF6}/\$AN\$29,0))$

(If is false)

Column	Label	Formula
AG	# Max Size Fiber Ca Urban High=	$=\text{TRUNC}(\text{IF}(\text{AF10}>\$AN\$29,\text{AF10}/\$AN\$29,0))$

(If is false)

Description:

This formula calculates the number of maximum size fiber feeder cables required in the current CBG feeder segment in the same manner as a number of maximum size copper feeder cables are determined.

**

Cell:

Column	Label	Formula
AH	Residual Fiber Cbl size Rural Low =	$=\text{IF}(\text{AF2}=0,0,\text{INDEX}(\$AL\$23:\$AL\$31,\text{MATCH}(\text{AF2}-$ $(\text{AG2}*\$AN\$29),\$AL\$23:\$AL\$31,-1),1))$

(If is false)

Column	Label	Formula
AH	Residual Fiber Cbl size Rural High =	$=\text{IF}(\text{AF5}=0,0,\text{INDEX}(\$AL\$23:\$AL\$31,\text{MATCH}(\text{AF5}-$ $(\$AN\$29*\text{AG5}),\$AL\$23:\$AL\$31,-1),1))$

(If is false)

Column	Label	Formula
AH	Residual Fiber Cbl size	=IF(AF6=0,0,INDEX(\$AL\$23:\$AL\$31,MATCH(AF6-(\$AN\$29*AG6),\$AL\$23:\$AL\$31,-1),1))
	Urban Low =	12
	(If is false)	

Column	Label	Formula
AH	Residual Fiber Cbl size	=IF(AF10=0,0,INDEX(\$AL\$23:\$AL\$31,MATCH(AF10-(\$AN\$29*AG10),\$AL\$23:\$AL\$31,-1),1))
	Urban High=	12
	(If is false)	

Description:

This formula calculates the size of the residual fiber cable required in the feeder segment. It uses the fiber feeder size table to search and report back. It reports the next largest fiber cable size above the number of actual fibers required after all pairs assigned to maximum cable sizes are subtracted.

The fiber sizing tables in the main logic tab appear as follows:

Feeder Cable Size Table

Cable Size

4200

3600

3000

2400

1800

1200

900

600

400

200

100

Distribution cable size table

Cable Size

3600

3000

2400

1800

1200

900

600

400

200

100

50

Fiber Feeder Size Table

Cable Size

144

96

72

60

48

36

24

18

12

The fill factor table and maximum cable size values are carried forward from the input table into the main logic sheet also.